What Is OPERATIONS

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The term is familiar. But what does it really mean? What should executives know about it? Here are answers from the experts.

HERE IS HOW IT IS DEFINED . . .

To find out what a technical term means, ask the men who use it. That's what DR&MI did with *Operations Research*, by means of a survey, directed to OR staff members in manufacturing firms and industrial consultants in the operations research field. The quotations below and the comments on the opposite page represent their replies.

PHILIP M. MORSE, *Massachusetts Institute of Technology*

Operations Research is the application of the quantitative, theoretical, and experimental techniques of physical science to a new subject, operations. An operation is the pattern of activity of a group of men and machines doing an assigned, repetitive task.

EDWARD C. VARNUM, *Barber-Colman Company*

Operations Research is the study and solution of problems related to the conduct of industrial or military enterprises, with emphasis upon the techniques and attitudes fostered by the training of its practitioners in pure science.

HORACE C. LEVINSON, *Industrial Consultant*

Operations Research is an application of the method and spirit of scientific research to problems that arise in the general areas of administration and organized activities. Its general purpose is to discover the most rational bases for action decisions.

JOHN E. KUSIK, VICE-PRESIDENT, *Chesapeake and Ohio Railway Company*

Operations Research may be defined as analysis of operations for decision-making purposes and for designing efficient operating systems. The only element of newness in Operations Research is a systematic search for opportunities for the application of scientific techniques developed in the various fields of science. Its greatest contribution to business lies in the emphasis on viewing problems from a company-wide perspective.

ELLIS A. JOHNSON, *Operations Research Office*

Operations Research is the prediction and comparison of the values, effectiveness, and costs of a set of proposed specific courses of action involving man-machine systems,

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JUDGING from the number of talks and seminars on Operations Research scheduled for the coming year, this is a hot topic indeed for the industrial executive. Few management meetings seem complete without a paper on OR these days.

But when it comes to defining the term, or telling how and where the technique should be used, it's a different story.

This is all the more surprising because there is little disagreement as to the origin of the term. It received its first major use during World War II to describe a group of methods, basically statistical in nature, used to study such military operations as strategic bombing, with a view to improving their efficiency.

As Philip M. Morse and George E. Kimball put it in their book on *Methods of Operations Research*, one of the first major publications on the subject:

Operations Research "first developed as a recognized activity in response to the military needs of World War II where it was sometimes known as operations analysis or evaluation. . . .

"However . . . the techniques and approach of Operations Research can be of help in arriving at executive decisions concerning operations in any field, industrial and governmental as well as military. . . ."

Because of the latter claim, and because *Operations Research* is a term that is increasingly used in management discussions, DUN'S REVIEW AND MODERN INDUSTRY has asked some of those who are most familiar with the term—OR consultants and the heads of OR departments in industry—to give their definitions of the term, and to tell who should use OR methods, and where they should be used. The replies to the survey are summarized in the boxes at the left and right.

The definitions (left) are self-explanatory, but the question of "most successful" and "least successful" applications deserves closer attention. The box at the right lists only industrial uses. However, a number of those who responded still feel that Operations Research scores its most notable successes in the military field—in the study of military tactics and strategy, weapons systems, fire control problems, mine detection, mobile gun design, and the like.

As one respondent put it, "these are nearer-term problems and have more specifically definable objectives" than have many industrial applications.

Naturally, most of those who incline to this view are the ones who first approached Operations Research from the military side. These individuals also tend to think of OR as a new entity; while those who approach OR from the industry side, and particularly those who have long used statistical techniques on industry problems, tend to feel that Operations Research is a new name, and perhaps a new package, for a familiar group of methods.

As Nyles V. Reinfeld of Executive Services, Inc. puts it: "The best definition of Operations Research would seem to be in terms of the tools or techniques used . . . and many of these techniques—mathematical programming, inventory management, game theory, and the like—predate Operations Research by many years." If, he says, the men

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working with inventory mathematics were not doing Operations Research, "then Operations Research would seem to result from the collective employment and knowledge of a body of these techniques."

Speaking to the last annual meeting of the American Society of Mechanical Engineers, Professor Andrew Schultz, Jr. of Cornell University said the methodology of Operations Research, as understood by the engineer in industry, "would involve the familiar steps of problem definition; definition of terms and measures; determination of facts; construction of the hypothesis or explanation by empirical, logical or intuitive means; and final testing of conclusions.

"This procedure in itself should not seem new to the engineer whose training involves the fundamentals of physical science," Schultz continues, "although some of the newer techniques may be unfamiliar . . . and . . . the application of the method to the area of operations may seem novel."

Though there are disagreements as to definitions and applications, perhaps the greatest spread of opinion relates to the place of Operations Research in the management scheme. Asked, "When an Operations Research Department is set up within a company, at what level should it report?" respondents covered the organizational front with their answers.

Several named specific job titles, "Executive Vice-President," "General Manager," and so on.

Others believe the Operations Research chief should report to "the executive with over-all responsibility for the operation being studied."

Others feel that he should report at a level *above* that of the man responsible for the job being studied —not to the responsible executive himself.

One respondent said the OR chief should report at the highest level at which "there is understanding and support for the work, and a chance of frequent, face-to-face contact."

Should Operations Research be centralized in a single department? "Yes, indeed," said several of its proponents. "Decidedly not," said others.

The first group feels that setting the Operations Research group on its own—perhaps as a management consulting section—enables it to be more objective and to give more complete service.

The second group feels that creating Operations Research cadres within the departments they are to serve makes for closer liaison and better understanding of the specific problems to be solved.

Most likely, each one is right—for his particular needs.

As a matter of fact, the best way to approach the whole Operations Research question is on the basis of specific needs, and with a good deal of caution.

As Reinfeld points out, there are real dangers in going overboard on this "new" idea. In so far as Operations Research becomes a management fad, its adoption may be akin to buying a machine when there is no clear idea as to how it will be used. Far better to approach the subject slowly and then set up a department and train one's own men in the techniques when one is sure of the job to be done.

A good way to start is with the papers delivered during the past three or four years at meetings of such organizations as the American Management Association, the American Society of Mechanical Engineers, the Society of Automotive Engineers, and the Industrial Engineering Institute of the University of California. Several other universities, and such Government organizations as the Office of Naval Research have also held seminars on Operations Research within the past three years.

The National Research Council has several brochures on Operations Research, prepared by its Advisory Committee; and the Council for Technological Advancement has prepared a good brief review of the subject.

Last, but by no means least, is the three-year-old Operations Research Society of America which holds regular meetings at which a good many of the experts in the field may be found.

. . . AND HOW IT IS USED

Operations Research seems to have been applied to almost every industrial process and system during the past ten years, with varying degrees of success. Many OR users think it is still too early for final decisions on specific applications, and point out that the way OR is used has much to do with its success. Nonetheless, here are applications which, users say, are:

Most likely to succeed

Production scheduling and telephone congestion
Machinery replacement theory
Investment management
Production and inventory control
Economic controls of manufacture
Machine allocation
Inventory management
Market forecasting

Less certain of success

Development of personnel functions
Organizational problems
Market research
Determining possible uses for new technical developments
Cost control
Long range inventory problems
Development of integrated data processing systems in the accounting function
Production scheduling
Analysis of inventory policy
Management decision problems
Any problem which does not involve a quantitative answer
Salary evaluation

On the middle ground (neither "most successful" nor "least successful"—but worth a try)

Distribution audits
Capital facilities planning
Electrical substation operations
Determining optimum size for mixing tanks
Determining number of men needed for maintenance operation
Plant and warehouse location studies
Control of productivity rates
Library operation
Advertising effectiveness
Service performance
Analysis of business operations
Allocation of marketing effort

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